

**REMARKS**

Claims 1-9 are pending in this application. By this Amendment, claim 10 is canceled without prejudice or disclaimer, and claim 1 is amended to incorporate the features recited in canceled claim 10. Also by this Amendment, claims 2-9 are amended for formality reasons. No new matter is added. Reconsideration of the application is respectfully requested.

The Office Action: (1) rejects claims 1, 3, 4, 8, and 9 under 35 U.S.C. § 102(b) as being anticipated by Fan et al. (International Publication No. WO 98/57207; hereinafter *Fan*); (2) rejects claims 5-7 and 10 under 35 U.S.C. § 103(a) as being unpatentable over *Fan*; and (3) rejects claim 2 under 35 U.S.C. § 103(a) as being unpatentable over *Fan* in view of Bong-Shik Song et al. (PTO-1449 form submitted February 2, 2006, reference no. 10 titled "Photonic Devices Based on In-Plane Hetero Photonic Crystals"; hereinafter *Song*). Applicants respectfully traverse the rejection of the claims.

**I. Claims Define Patentable Subject Matter****A. Claims 1 and 3-9 are Patentable Over Cited Prior Art**

With respect to independent claim 1, Applicants assert that *Fan* fails to disclose or suggest a two-dimensional photonic crystal multiplexer/demultiplexer including at least two point-like defect resonators composed of point-like defects having substantially the same resonance wavelength and arranged in series between first and second optical input/output sections, where each point-like defect consists of a point-like region devoid of modified refractive index areas, and wherein a value of a coupling ratio defined as  $\mu^2/[(\omega_0/2) \times (1/Q_{in} + 1/Q_v)]^2$  is 0.2~10, where  $\omega_0$  is a resonance frequency of the point-like defect resonators,  $Q_{in}$  is a Q-value between one of the first and second optical input/output sections and the point-like defect resonator closest to the section,  $Q_v$  is a Q-value between each of the point-like defect resonators and an outside of the crystal, and  $\mu$  is a mutual coupling coefficient between the point-like defect resonators, as recited in independent claim 1.

In contrast, *Fan* discloses a channel drop filter having a coupling element that includes a resonator-system between two waveguides (*Fan*, Abstract). *Fan* teaches that the filter achieves maximum efficiency when, *inter alia*, the two resonant states of the filter structure have substantially the same quality factor (i.e., Q-value), as determined from the decay of the resonances into the waveguide modes (*Fan*, pg. 9, ll. 26-33; *See also* pg. 11, line 38 to pg. 11, line 8; pg. 22, line 36 to pg. 23, line 6).

However, as the Office Action correctly recognizes, *Fan* does not teach or suggest the coupling ratio as defined in the claims (Office Action, pg. 4, ¶ 15). Next, with respect to claim 2, the Office Action alleges that *Song* cures the deficiencies of *Fan* by teaching a photonic device having seven photonic crystals having different lattice constants (*Song*, Figs. 1A and B). *Song*, however, also fails to disclose or render obvious the coupling ratio as defined in the claims. Accordingly, a combination of *Fan* and *Song* would not arrive at the subject matter as recited in claim 2.

Instead, the Office Action alleges that "it would have been obvious to one of ordinary skill in the art at the time of invention to use such a coupling ratio" because "discovering an optimum value of a result effective variable involves only routine skill in the art" (Office Action, pg. 4, ¶ 15). Applicants respectfully disagree.

Q-value is an index that represents the performance of a resonator, which is inversely proportional to the percentage of energy leaking from the resonator per unit of time (Specification, pg. 8, ll. 7-9; *Fan*, pg. 32, ll. 3-5). In the field of photonic crystal resonators, greater Q-value is desirable because that reduces the amount of energy of light leaking from the resonator (Specification, pg. 8, ll. 9-10). For example, *Fan* teaches that "as the external [Q-value] increases, the magnitude of the tuning range required for the absorption coefficients decreases" (*Fan*, pg. 34, ll. 35-38). *Fan* further teaches that when the external Q-factor is on the order of a thousand or higher, "significant switching action can [] be achieved" (*Fan*, pg.

34, ll. 32-35). Thus, Applicants respectfully assert that one of ordinary skill in the art would design resonators (e.g., a two-dimensional photonic resonator) having the maximum possible Q-value.

Rather than attempting to maximize the Q-value in all cases, the recited two-dimensional photonic crystal multiplexer/demultiplexer adjusts one of the Q-values (e.g.,  $Q_v$ ) and a mutual coupling coefficient (e.g.,  $\mu$ ) to maintain a coupling ratio within a predetermined range, where the coupling ratio =  $\mu^2 / [( \text{resonant frequency} / 2 ) \times ( 1 / Q_m + 1 / Q_v )]^2$ . Depending on the resonant frequency and/or the mutual coupling coefficient, it may not be possible to maintain the coupling ratio within the predetermined range when the Q-values are at their maximum. Therefore, one or more of the Q-values (e.g.,  $Q_v$ ) may need to be set at less than maximum, which would cause the multiplexing/demultiplexing efficiency to decrease in a conventional resonator. Additionally, Applicants respectfully direct the Office's attention to Figures 3A, 3B, and 8 and their corresponding disclosures (e.g., Specification, ¶¶ [0027], [0028], and [0040]) for a disclosure of the unexpected increase in the multiplexing/demultiplexing efficiency when the frequency deviates from a predetermined value, which is achieved by decreasing the value of  $Q_v$  against conventional practices. Accordingly, Applicants respectfully assert that it would not have been obvious to one of ordinary skill in the art at the time of invention to use a coupling ratio as recited in independent claim 1.

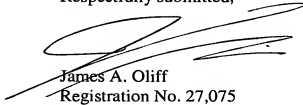
Therefore, Applicants submit that independent claim 1 is patentable over cited prior art. Claims 2-9 depend from claim 1, and therefore, also define patentable subject matter, as well as for the additional features they recite. Accordingly, Applicants respectfully request the withdrawal of the § 102(b) rejection of claims 1, 3, 4, 8, and 9 based on *Fan* and the § 103(a) rejections of claims 5-7 based on *Fan* and claim 2 based on *Song*.

## **II. Conclusion**

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-9 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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